

**REMARKS**

By the above amendment, claims 1 and 3 have been amended. Applicants note that support for the amendment can be found in the specification, e.g., at page 16, lines 3-4 of the present application.

In view of the above amendment and the following response to the Office Action, Applicants hereby believe that all the claims of the application are in condition for allowance.

**RESPONSE TO THE OFFICE ACTION****Allowance of claims**

Applicants note with appreciation that the Examiner has allowed claims 2,4 and 10-13.

**Art-based rejections**

The Office Action asserts the following rejections:

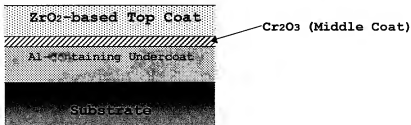
- (a) Claim 1 is rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,912,087 to Jackson et al (“Jackson”).
- (b) Claim 3 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious based on Jackson in view of U.S. Patent No. 5,985,467 to Beele (“Beele”).
- (c) Claim 5 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious based on Jackson in view of U.S. Patent No. 5,273,712 to Czech et al. (“Czech”).
- (d) Claim 6 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious based on Jackson in view of U.S. Patent No. 4,714,624 to Naik et al. (“Naik”).
- (e) Claim 7 is rejected under 35 U.S.C. § 103(a) as allegedly being obvious based on Jackson in view of U.S. Patent No. 5,514,482 to Strangman et al. (“Strangman”).

In response to the anticipation rejections, Applicants note that a rejection under 35 U.S.C. § 102 can only be maintained if every element of the rejected claim is found in a single prior art document.

Applicants note that Jackson fails to disclose every element of amended claim 1. Specifically, Jackson does not disclose that a "*Cr<sub>2</sub>O<sub>3</sub> layer is formed through a chemical densification treatment by applying an aqueous solution*" as recited in claim 1. With respect to the secondary documents cited for the obviousness rejection that, Applicants note that none of these documents discloses the above-noted element either.

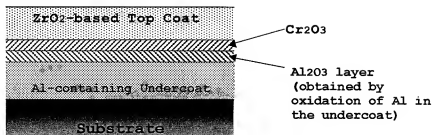
With respect to the rejections under 35 U.S.C. § 103(a), Applicants note that each of the cited documents fails to disclose the above-noted element of amended claim 1. Furthermore, Applicants submit that the present application may be distinguished from Jackson and/or any secondary documents by the following remarks (which are to be illustrative only).

The coating material of claim 1 has a structure shown in the following sketch (A).



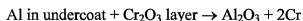
(A)

When the thermal barrier coating (TBC) having such a structure is used for a long time under a high temperature environment in a turbine or the like, it changes into a structure of claim 2 as shown in the following sketch (B).

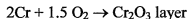


(B)

That is, as the chemically densified  $\text{Cr}_2\text{O}_3$  layer (exterior-feed type) is formed on the upper surface of the Al-containing undercoat, when TBC is exposed to a high temperature environment, Al in the undercoat reacts with the  $\text{Cr}_2\text{O}_3$  layer to form a new  $\text{Al}_2\text{O}_3$  layer having a protection property between the undercoat and the middle coat ( $\text{Cr}_2\text{O}_3$  layer) represented by the following equation:



Moreover, Cr is oxidized into  $\text{Cr}_2\text{O}_3$  by  $\text{O}_2$  in the combustion gas permeated through the top coat as represented by the equation:



Therefore, the middle coat appears to have not chemically changed from the initial structure.

On the other hand, metals other than Al included in the undercoat such as Cr, Ni, Co and the like cannot thermodynamically react with the  $\text{Cr}_2\text{O}_3$  layer, so that they remain in the undercoat at a metallic state.

The above reactions are described in the specification in detail.

With respect to the cited documents, Jackson discloses on column 7, lines 13-16 that the metallic constituent of the bond coat (corresponding to the undercoat of the present invention) is aluminum- and/or chromium-containing composition (i.e. those containing alumina- and/or chromia-formers). In this case, the alumina-former means an alloy producing  $\text{Al}_2\text{O}_3$  film when Al-containing alloy is heated in air to preferentially oxidize Al other than the other components in the alloy, while the chromia-former means an alloy producing  $\text{Cr}_2\text{O}_3$  film when Cr-containing alloy is heated in air to preferentially oxidize Cr other than the other components in the alloy. Therefore,  $\text{Cr}_2\text{O}_3$  layer of Jackson is formed by oxidizing Cr in the chromia-former constituting the bond coat.

In the present invention, even if Al and Cr are included in the undercoat, as the  $\text{Cr}_2\text{O}_3$  layer of exterior feed type as a middle coat is previously formed on the undercoat, only  $\text{Al}_2\text{O}_3$  is formed between the undercoat and the middle coat, and  $\text{Cr}_2\text{O}_3$  is never replenished therebetween.

In view of the foregoing remarks, Applicants submit that the present invention is entirely different from Jackson and cannot easily be conceived therefrom by someone of skill in the art.


## CONCLUSION

In view of the foregoing, it is submitted that none of the cited documents of record, either taken alone or in any proper combination thereof, anticipates or renders obvious the Applicant's invention, as recited in each of the claims. In addition, the applied cited documents of record

have been discussed and distinguished, while significant claimed features of the present invention have been pointed out.

Accordingly, reconsideration of the outstanding Office Action and allowance of the present application and all the claims therein are respectfully requested and now believed to be appropriate.

Respectfully submitted,  
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August 30, 2007  
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